Remarks

Reconsideration of this Application is respectfully requested. This Supplemental Amendment is submitted with claims 7 and 8 included, as noted in the Notice of Non-compliant amendment. The remainder of the response to the Office Action dated July 2, 2003 is identical to that filed on October 2, 2003.

Upon entry of the foregoing amendments, claims 1-20 are pending in this application, with claims 1, 6, 9, 14 and 20 being the independent claims. Claims 1, 6, 14 and 20 are amended. These changes are believed to introduce no new matter, and their entry is respectfully requested.

In the Office Action dated July 2, 2003, the finality of the previous Office Action has been withdrawn. Claims 1, 6, 9 and 14 stand rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over Buzbee *et al.*, U.S. Patent No. 5,815,720 (Buzbee '720) in view of Buzbee *et al.*, U.S. Patent No. 6,275,981 (Buzbee '981) and further in view of Goebel, U.S. Patent No. 6,139,200. Claims 2, 10 and 15 stand rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over Buzbee '720 in view of Buzbee '981 and further in view of Goebel and Chaitin, U.S. Patent No. 4,656,582. Claims 4, 5, 8, 12, 13, 17 and 18 stand rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over Buzbee '720 in view of Buzbee '981 and further in view of Goebel, Morgan, "Building and Optimizing Compilers" and Larus, U.S. Patent No. 6,327,699. Claim 19 stands rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Buzbee '720 in view of Buzbee '981 and further in view of Dean *et al.*, U.S. Patent No. 6,070,009 and Goebel. Claim 20 stands rejected under 35 U.S.C. § 103(a) as being

allegedly unpatentable over Buzbee '720 in view of Dean *et al.* and further in view of

Goebel.

The rejections of independent claims based on Buzbee '720, Buzbee '981 and Goebel.

Applicants note that in several places the Office Action refers to Buzbee *et al.*,

U.S. Patent No. 5,815,720 as "U.S. Patent No. 5,815,721," apparently due to

typographical error. That reference will be referred to in this response as "Buzbee '720."

Claim 1 recites that the "first intermediate representation includes instructions

instrumented into the **source code** of said computer program." None of the cited

references instrument instructions into the source code. The present invention, in fact,

uses a compiler to insert a profiling code into the compiler's intermediate representation

of the **source code before** applying optimization. Buzbee '720, in contrast, uses a

dynamic translator to insert profiling code into the **object code after** the compiler has

finished. Furthermore, Buzbee '720 emphasizes, at column 2, lines 35-45, that the

advantage of their invention is in **not** inserting profiling code during the compilation

process. Therefore, instrumenting code during the compilation would defeat the purpose

of Buzbee '720, and is expressly contrary to its teaching.

Claim 1 (as amended) also recites the step of "annotating said first intermediate

representation with previously-gathered frequency data from a plurality of sample

executions of said computer program." This is different from what Buzbee '720 teaches.

Buzbee '720 uses profile data during a second compile task to produce an optimized

application (see Buzbee '720, column 3, lines 56-65). However, the frequency at issue in

Buzbee '720 is the **frequency of the object code**. In contrast, the frequency at issue in

the present invention is the frequency of the compiler's intermediate representation.

Also in the present invention, the compiler uses a predefined propagation scheme to update the frequency data, as recited in claim 1. The "update" here refers to the compiler maintaining the accuracy of the frequency data as the compiler transforms the intermediate representation. Since Buzbee's '720 data is gathered by instrumenting **object code**, it measures the execution frequencies of the **object code**. Therefore, Buzbee '720 does not update its frequency data. Furthermore, it would make no sense to update the frequency data in Buzbee '720 when the source code is optimized, because the data measures execution frequencies in the object code, not in the source code.

None of the other references cited in the Office Action remedy this deficiency in the rejection as it relates to the difference between the frequencies of the source code versus the object code. Applicants further note that the annotations mentioned in the alternative embodiment in Buzbee '720 (see column 5, lines 27-29) are not feedback data, and they do not measure frequency. Instead, they have a different purpose - to tell the dynamic translator which code to insert and where.

With regard to Goebel, the Office Action states, at page 3, that "Goebel, however, does teach performing multiple feedback data updates and optimization in a single compiler pass." Applicants respectfully disagree. Goebel uses the word "feedback," but refers to an entirely different concept. The "feedback data" in Goebel measures register spillage and properties of the register interference graph (see, for example, column 9, lines 31-37 of Goebel). The "feedback data" of Goebel is only meaningful in the context of register allocation. On the other hand, in claim 1, the feedback data measures execution frequency of program code, and has meaning and utility during all compilation phases.

Additionally, Goebel never updates its "feedback data." After performing code optimization, Goebel recomputes the data (see, for example, FIG. 5, items 540 and 570, and column 10, lines 42-47 of Goebel). On the other hand, the invention as claimed in claim 1 updates the numerical frequency data according to a predefined propagation scheme -- in other words -- in response to transformation of the code's intermediate representation.

In order to avoid unnecessary controversy, Applicants have replaced the term "feedback data" with "<u>frequency</u> data" in claim 1, in order to more clearly point out the nature of the data at issue. As discussed above, this aspect of the present invention is not taught or suggested by Goebel.

With regard to Buzbee '981, the frequency data in Buzbee '981 is obtained from a completely different source, and there is no discussion in Buzbee '981 of updating the frequency data as the compilation proceeds. The '981 patent is directed to an entirely different problem, as may be seen in column 2 lines 46-59 of Buzbee '981.

Independent claims 6, 14 and 20 have been similarly amended to recite <u>frequency</u> data instead of feedback data. These claims are allowable at least for the reasons applicable to claim 1, as well as due to the features recited therein. Independent claim 9 already recited frequency data, and has not been amended, but is allowable at least for the same reasons. Accordingly, Applicants respectfully request that the rejections of the independent claims under 35 U.S.C. § 103(a) be reconsidered and withdrawn.

Dependent claims 2-5, 7-8, 10-13 and 15-19 depend from claims 1, 6, 9 and 14, respectively, and are allowable at least because their base claims are allowable, as well as due to the features recited therein.
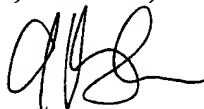
Conclusion

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. Applicants believe that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment and Reply is respectfully requested.

Respectfully submitted,

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